

### **Remarks**

Claims 1-74 are pending, of which claims 22-58 were withdrawn. Applicants have now amended claims 63-68 and 71-74, cancelled claims 69 and 70 without prejudice and added claim 75. Applicants respectfully request the allowance of claims 63-76.

### **Substance of the Examiner Interviews**

The undersigned attorney wishes to thank Examiner Wartalowicz for the telephone interviews on or about October 2, 2008 and October 28, 2008. Examiner Wartalowicz the undersigned attorney were present at both interviews.

During the interview on or about October 2, 2008, the *Jia* reference (C.L. Jia *et al.*, "Effect of chemical and ion-beam etching on the atomic structure of interfaces in  $\text{YBa}_2\text{Cu}_3\text{O}_7/\text{PrBa}_2\text{Cu}_3\text{O}_7$  Josephson junctions", *Appl. Phys. Lett.*, Vol 67, No. 24, 3635-3637 (1995)) was discussed. Specifically, the nature of the  $\text{PrBa}_2\text{Cu}_3\text{O}_7$  layer disclosed in the *Jia* reference was discussed. The Examiner indicated that he was willing to reconsider the significance of the *Jia* reference when a response to the Office Action was submitted.

No agreement as to the merits of the claims was reached.

During the interview on or about October 28, 2008, the Advisory Action was discussed. The Examiner confirmed that he declined to enter the Applicants' Reply submitted on October 9, 2008, not on the merits of the Applicants arguments and additions presented therein, but because certain amended and new claims presented new combinations of limitations and it was not clear to the Examiner that the amendments were adequately supported.

### **Explanations of the Claim Amendments and Addition**

Applicants have now amended claims 63-68 and 71-74, cancelled claims 69 and 70 without prejudice and added claim 75. The details of the amendments and additions are as follows:

Claim 63 has been amended into independent form, incorporating the limitations of claim 1 of the Supplemental Amendment of August 14, 2008, except that the phrase

“substantially uniform” has been removed from “substantially uniform barrier layer”. In essence, claim 63 now incorporates the limitations of claim 1 of the Amendment filed on April 28, 2008.

Furthermore, “with a  $1\sigma$  value” has been added to the last clause to clarify the limitations on the variability in  $I_c$  and  $R_n$ . The support for this clarification is found at least at page 13, lines 15-19 of the original Specification.

Claim 64 has been amended to similarly add the clarifying phrase “with a  $1\sigma$  value”.

Claim 65 has been amended into independent form, incorporating the limitations of claim 59 of the Supplemental Amendment of August 14, 2008, except that the phrase “substantially uniform” has been removed from “the third layer being substantially uniform”.

Claim 66 has now been amended to depend on claim 65 instead of claim 62, and the limitation on the  $R_nA$  range has been replaced by the limitation of YBCO superconducting oxide for the first layer. Because claim 65 now depends on claim 59, which already includes the limitation on  $R_nA$  range, and now-cancelled claim 62 included the YBCO requirement and also ultimately depended on claim 59, the amendment to claim 66 does not introduce any new combination.

Claim 67 has been amended into independent form, incorporating the limitations of claim 1 of the Supplemental Amendment of August 14, 2008, except that the phrase “substantially uniform” has been removed from “substantially uniform barrier layer”. In essence, claim 67 now incorporates the limitations of claim 1 of the Amendment filed on April 28, 2008.

Claim 68 has now been amended to depend on claim 67 instead of claim 7, and the limitation on the  $R_nA$  range has been replaced by the limitation of YBCO superconducting oxide for the first layer. Because claim 67 already includes the limitation on  $R_nA$  range, and now-cancelled claim 7 included the YBCO requirement and also ultimately depended on claim 1, the amendment to claim 68 does not introduce any new combination.

Claims 69 and 70 have been cancelled without prejudice.

Claim 71 has been amended into independent form, incorporating the limitations of claim 59 of the Supplemental Amendment of August 14, 2008, except that the phrase “substantially uniform” has been removed from “the third layer being substantially uniform”. In essence, claim 71 now incorporates the limitations of claim 59 of the Amendment filed on April 28, 2008.

Claim 72 has now been amended to depend on claim 71 instead of claim 62, and the limitation on the  $J_c$  range has been replaced by the limitation of YBCO superconducting oxide for the first layer. Because claim 72 now depends on claim 71, which already includes the limitation on  $J_c$  range, and now-cancelled claim 62 included the YBCO requirement and also ultimately depended on claim 59, the amendment to claim 72 does not introduce any new combination.

Claim 73 has been amended into independent form, incorporating the limitations of claim 1 of the Supplemental Amendment of August 14, 2008, except that the phrase “substantially uniform” has been removed from “substantially uniform barrier layer”. In essence, claim 73 now incorporates the limitations of claim 1 of the Amendment filed on April 28, 2008.

Claim 74 has now been amended to depend on claim 73 instead of claim 7, and the limitation on the  $J_c$  range has been replaced by the limitation of YBCO superconducting oxide for the first layer. Because claim 73 already includes the limitation on  $J_c$  range, and now-cancelled claim 7 included the YBCO requirement and also ultimately depended on claim 1, the amendment to claim 74 does not introduce any new combination.

New claim 75 depends on claim 65 and further includes the limitation that “the third layer is substantially uniform”. Because claim 65 which, as explained above, has been amended into independent form, incorporating the limitations of claim 59 of the Supplemental Amendment of August 14, 2008, except that the phrase “substantially uniform” has been removed from “the third layer being substantially uniform”, claim 75 is identical in scope as the version of claim 65 presented in the Supplemental Amendment of August 14, 2008. Therefore, new claim 75 does not introduce and new combination of limitations.

Applicants therefore respectfully submit that no new combination has been introduced by any claim amendment presented herein.

#### **Claim Rejections – 35 U.S.C. § 103**

Claims 1-5, 7-21 and 59-74 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over *Harada* ("Fabrication of all-high-Tc Josephson junction using as-grown YBa<sub>2</sub>Cu<sub>3</sub>O<sub>x</sub> thin films," *Jap. J. Appl. Phys.*, vol. 30, pp. L1387-89 (1991)) in view of *Chan* (U.S. 5,892,243) and either *Hunt* (Hunt, B. *et al.*, "High Temperature Superconductor Weak Links", *Second Symposium on Low Temperature Electronics and High Temperature Superconductivity*, Electrochemical Society Meeting, Honolulu, Hawaii, Vol. 93-22, p. 467-472 (May 1993)) or *Jia*. Applicants' cancellation of claims 1-63 renders the rejections of claims 1-5, 7-21 and 59-62 moot. Applicants respectfully submit that, as previously presented, claims 63-74 contain allowable subject matter. Applicant has now amended claims 63-74 to either independent form, incorporating all limitations of any base claim and intervening claims or dependent claims based on respective non-cancelled claims without intending to surrender any claim scope as previously presented. Applicants respectfully submit that claims 63-74 are allowable as amended.

Regarding claims 63 and 64, each of the claims includes, among other things, the feature that a plurality of Josephson junction devices fabricated on a substrate have respective  $I_c$  values within a certain variability range of each other and respective  $R_n$  values within a certain variability range of each other. Such uniformity is achieved due to the uniform nature of the ion-modified barrier layer. Neither *Hunt* nor *Jia* discloses or suggest this feature. Indeed, neither reference discloses variability in junction properties. In fact, on the bottom of page 4 of *Hunt*, *Hunt* states that "The critical current densities of the ion-damage weak links appear to be relatively insensitive to ion cleaning energy and ion species, indicating that  $J_c$  in these devices is not controllable over a wide range. This is a problem for some cases in which control of  $J_c$  is required, such as integrated circuit applications." The fact that  $J_c$  is not controllable in these devices implies that they are not uniform. On page 3 of *Hunt*, *Hunt* states that "The degraded layer on the YBCO base electrode is caused by ion damage during the edge cutting and edge cleaning steps, and

presumably consists of both crystalline defects and stoichiometry shifts associated with preferential ion sputtering.” *Degraded* layers, ion *damage*, crystalline *defects*, and stoichiometry *shifts* are in direct contradiction to uniform layers and indeed indicate nonuniformity. Regarding *Jia*, there is in the *Jia* reference no discussion whatever of Josephson junction parameters. Indeed, *Jia* provides no evidence that the structures discussed are even Josephson junctions, i.e., no electrical measurement are presented. For at least these reasons, Applicants respectfully request the withdrawal of the rejection of claims 63 and 64 as being unpatentable over *Harada* and *Hunt* or *Jia*.

Regarding claims 65-74, or which claims 69 and 70 have now been cancelled without prejudice, the Examiner relies on *Harada* and *Jia* for the rejection. As discussed in Applicants’ Amendment submitted on April 28, 2008, including the Declaration of Prof. Rowell, *Harada* does not disclose a barrier made of an ion-modified layer of a superconducting electrode. The Amendment of April 28, 2008 is incorporated herein by reference. Further, *Harada* fails to disclose or suggest the  $I_C$  or  $R_n$  values in the ranges in claims 65-74.

As to *Jia*, the Examiner contends that it discloses a substantially similar process of making the barrier layer as that of the claimed invention such that the properties of the barrier layer of *Jia* are substantially similar to the properties of the barrier layer of the claimed invention. Applicants respectfully disagree with the Examiner. *Jia* discloses a Josephson junction with a layered structure of  $YBa_2Cu_3O_7/PrBa_2Cu_3O_7/YBa_2Cu_3O_7$ , in which the  $PrBa_2Cu_3O_7$  layer is a deposited non-superconducting barrier. See, e.g., *id* at Abstract (“...Josephson junctions formed by epitaxial  $YBa_2Cu_3O_7/PrBa_2Cu_3O_7/YBa_2Cu_3O_7$  triple-layer films ...”) and p. 3635, left column, first paragraph (“In most cases  $PrBa_2Cu_3O_7$  is employed as nonsuperconducting barrier material.”) The method disclosed in the present application and resulting in the device claimed in claims 65-74, in contrast, produces a barrier layer that is ion-modified from one of the superconductor electrodes. Therefore, the process in *Jia* is very different from that of the claimed invention such that the properties of the barrier layer of *Jia* cannot be predicted to be substantially similar to the properties of the barrier layer of the claimed invention. Moreover, in order for a device to be classified as a Josephson junction, it must display Josephson properties when measured electrically. *Jia* presents no electrical

measurements, no measured values of  $I_c$  or  $R_n$ , and no evidence that the structures discussed operate as Josephson junctions. For at least these reasons, Applicants respectfully request the withdrawal of the rejection of claims 65-68 and 71-74.

**New Claims**

New claim 75 has been added. For at least the same reasons stated above, claim 75 should be allowed.

**SUMMARY**


In view of the above amendments and remarks, Applicant respectfully requests a Notice of Allowance. If the Examiner believes a telephone conference would advance the prosecution of this application, the Examiner is invited to telephone the undersigned at the below-listed telephone number.



Date: November 18, 2008

Respectfully submitted,

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